

Sampling Manures





INTRODUCTION

- **Benefits to Manures**
- **Why Manures Vary**
 - **Animal type**
 - **Bedding**
 - **Ration**
 - **Storage/Handling**
 - **Environment**
 - **Application Method**
 - **Age**

Testing

- **May better indicate how animal management and other factors actually affect nutrient content.**
- **Good sampling technique is critical for having confidence in test results.**
- **Critical for estimating nutrient loading**



TECHNIQUE

- **Sample from loaded spreaders is best**
- **Variability**
 - **Greater from barnyard and pack vs. loaded spreader**
- **Take several samples helps reduce variability.**
- **Variability exists even under the most ideal conditions**



5-gallon bag

- **Thoroughly mixed**
- **24 subsamples**
 - **Still high variability**
 - **Less with liquid**
 - **More with solids**

TIME – Dairy Manure

- Over 3-yr period
 - Little change in N
 - Larger change in K
- Consistent Results Possible
 - With good representative sampling
 - Same herd management



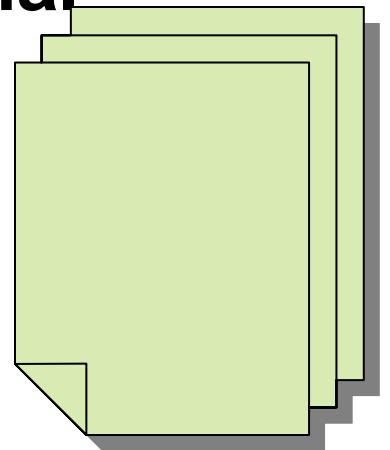
TIME – Chicken Manure

- **Over 5-month period**
 - **High variability for all parameters**
- **Inconsistent results due to**
 - **Seasonal changes in feed**
 - **5 to 6 batches of birds before sampling**

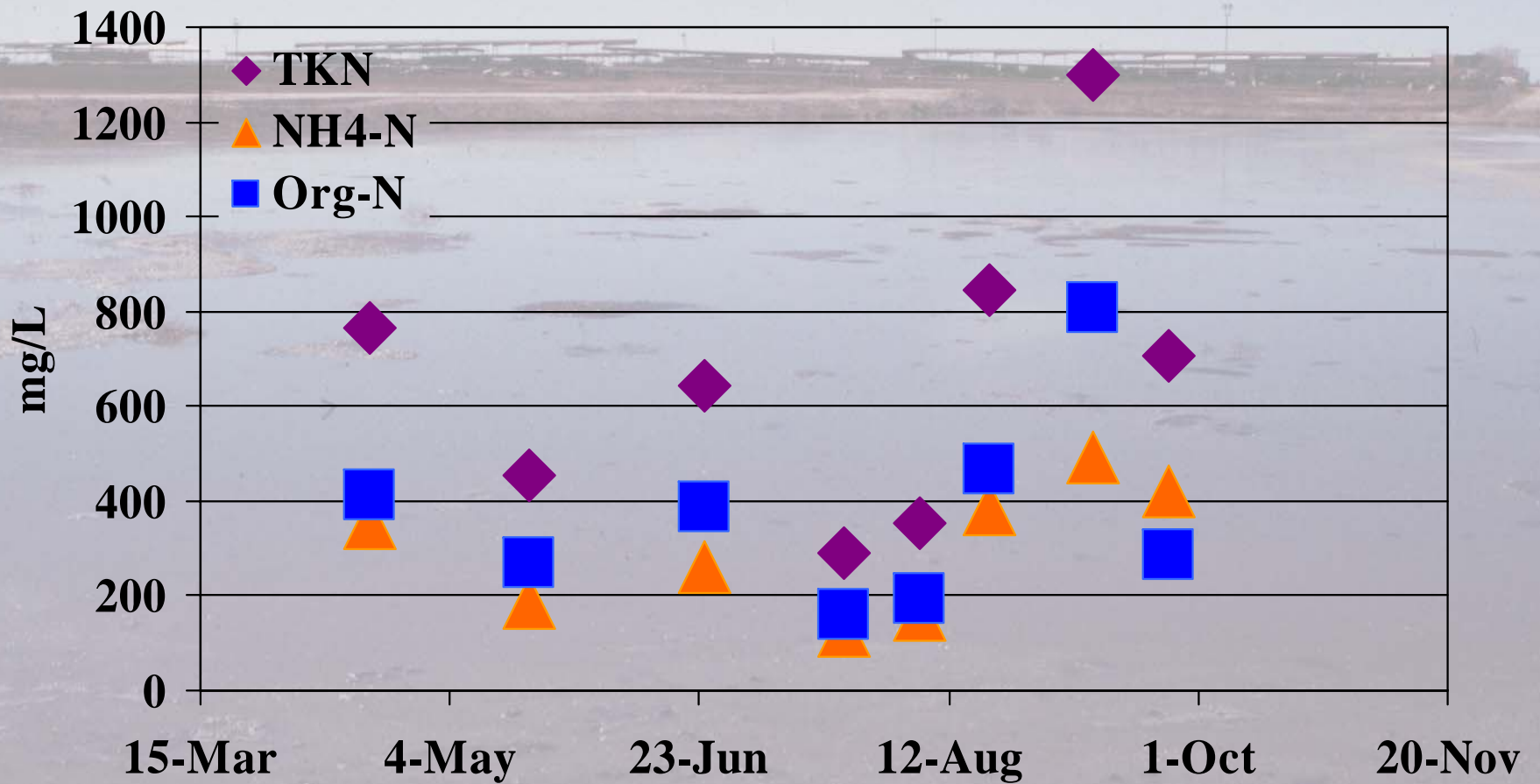


Use Long-term Farm Averages

- **Only if herd and manure management practices have not changed.**
- **IF no baseline**
 - **Develop a historic record over 2 – 3 years**
 - **Sample just prior to land application**
 - **Note time of year to monitor potential seasonal variability.**



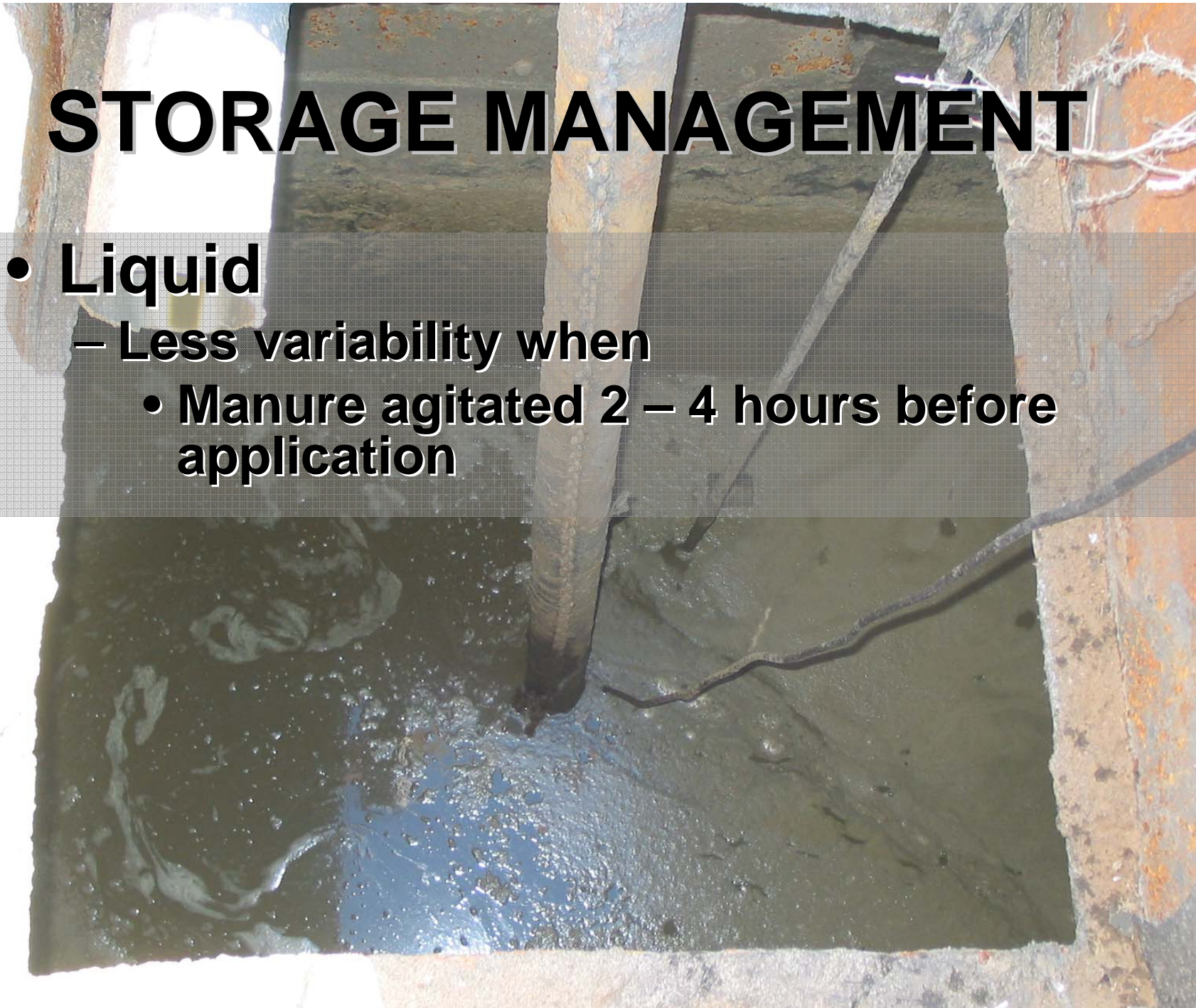
Lagoon water N variation over time



ASC-Artesia

STORAGE MANAGEMENT

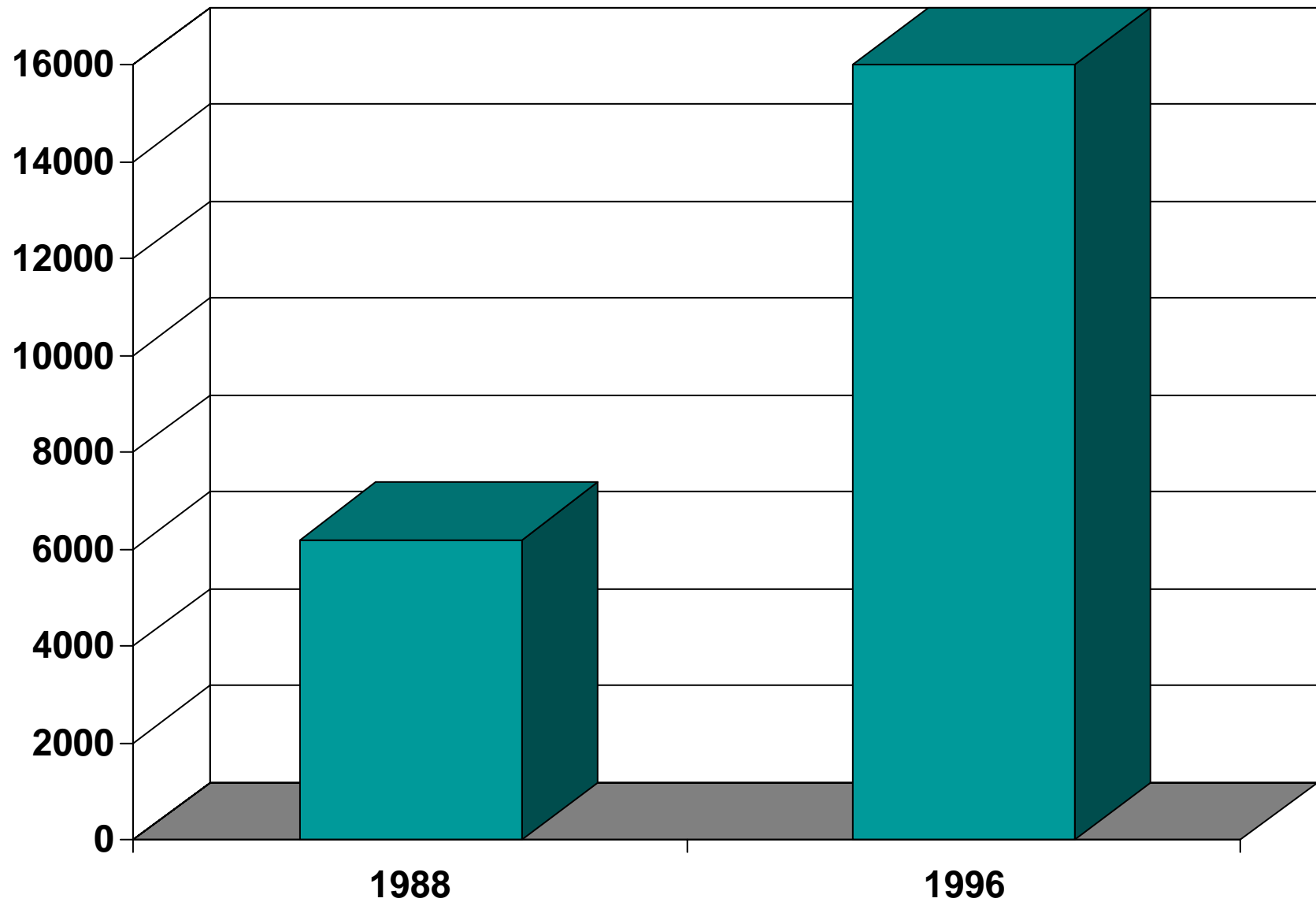
- **Liquid**
 - Less variability when
 - Manure agitated 2 – 4 hours before application



SAMPLING RECOMMENDATIONS



Manure samples from private & public labs



However

- **Most livestock operations still don't sample manure. Why?**
 - **Sample Heterogeneity**
 - **Inherent difficulty in obtaining a representative sample**



General Guideline

- Avoid Heterogeneity by not sampling:
 - Bedded packs
 - Unagitated liquid storage facilities
- Poorly sampled systems will not improve accuracy of estimating N and P loading
- Adequate subsampling very important

RECOMMENDED PROCEDURES

- **Mixing a solid sample**
 - **Pile manure**
 - **Shovel from outside to inside until well mixed**
- **Fill a 1-gallon heavy-duty sealable plastic bag half full with composite sample**
- **Squeeze air out, close, and seal**
- **Store below freezing unless delivered immediately.**

Sample While Loading

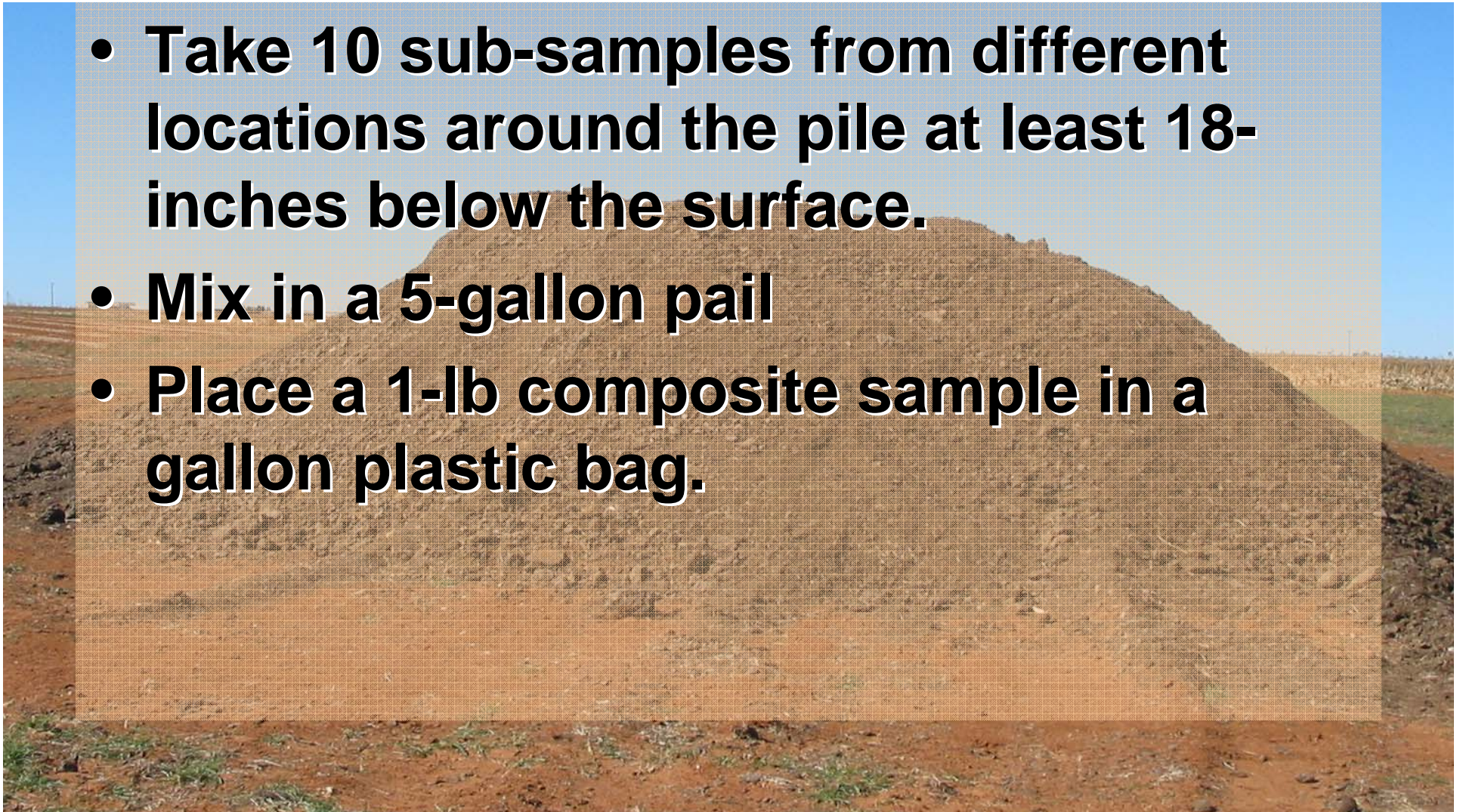
- Take at least 5 samples while loading several spreader loads
- Combine to form one composite sample
- Thoroughly mix the composite sample and remove a 1-lb subsample using a one-gallon plastic bag.
- Do not sample directly from pack or bed

Sample While Spreading

- Take at least 5 samples while loading several spreader loads
- Combine to form one composite sample
- Thoroughly mix the composite sample and remove a 1-lb subsample using a one-gallon plastic bag.
- Do not sample directly from pack or bed

Sample Stockpiled Manure

- Take 10 sub-samples from different locations around the pile at least 18-inches below the surface.
- Mix in a 5-gallon pail
- Place a 1-lb composite sample in a gallon plastic bag.



Number of Sub-samples 10% error - Colorado study

Type	TKN	P	K	NH ₄	NO ₃
Beef	17	20	32	121	692
Dairy compost		5	119	92	191
Dairy manure		49			1914
Turkey			13		

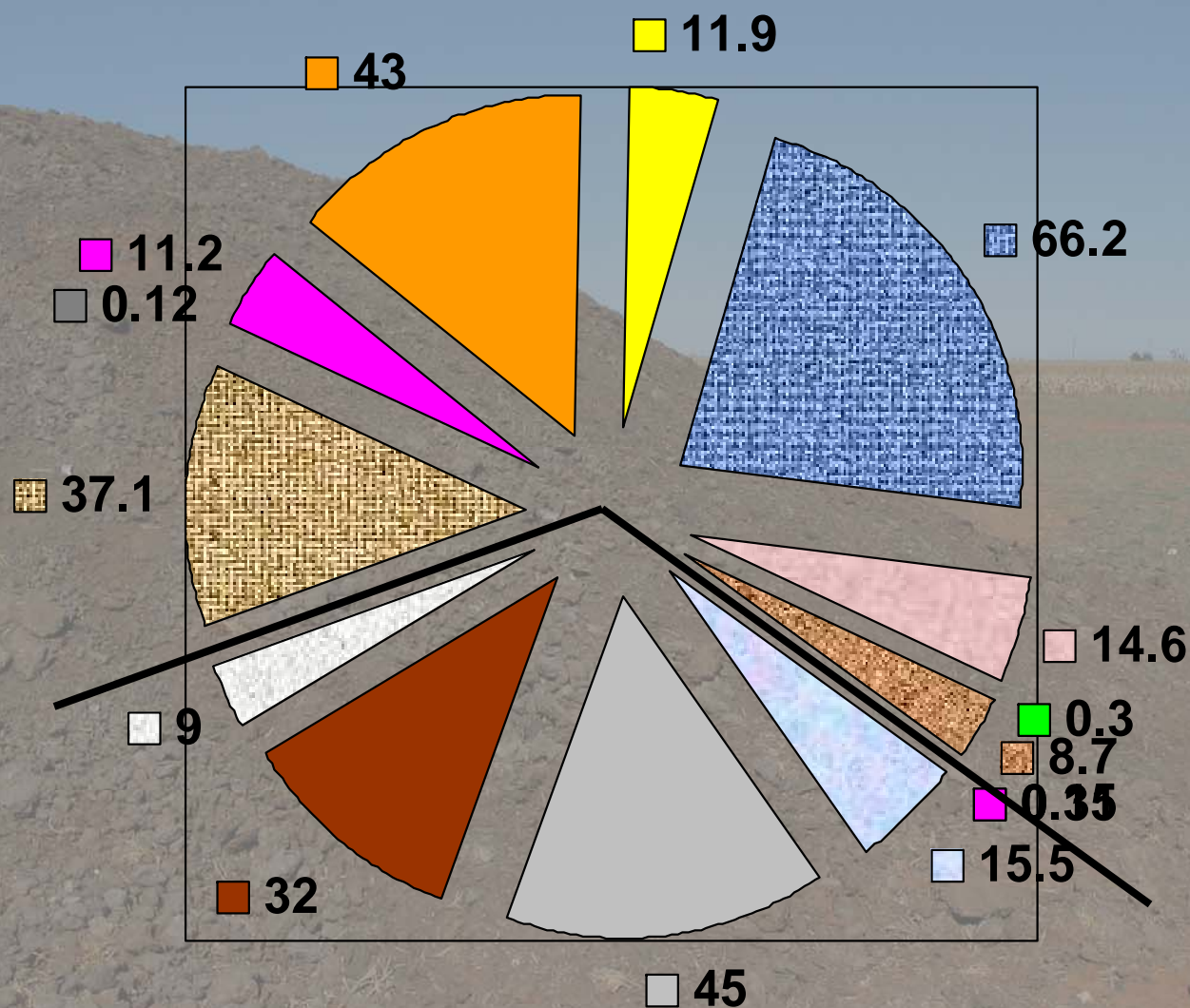
Inorg. N not recommended!

Number of Subsamples for TKN

Type	CI (95%)	Std Dev	Subsamples
Pen	1.5 – 2.6	0.22	7
Separator	0.3 – 3.0	0.72	-
Stockpiled	1.0 – 1.9	0.35	30
Composted	0.1 – 2.0	0.06	2

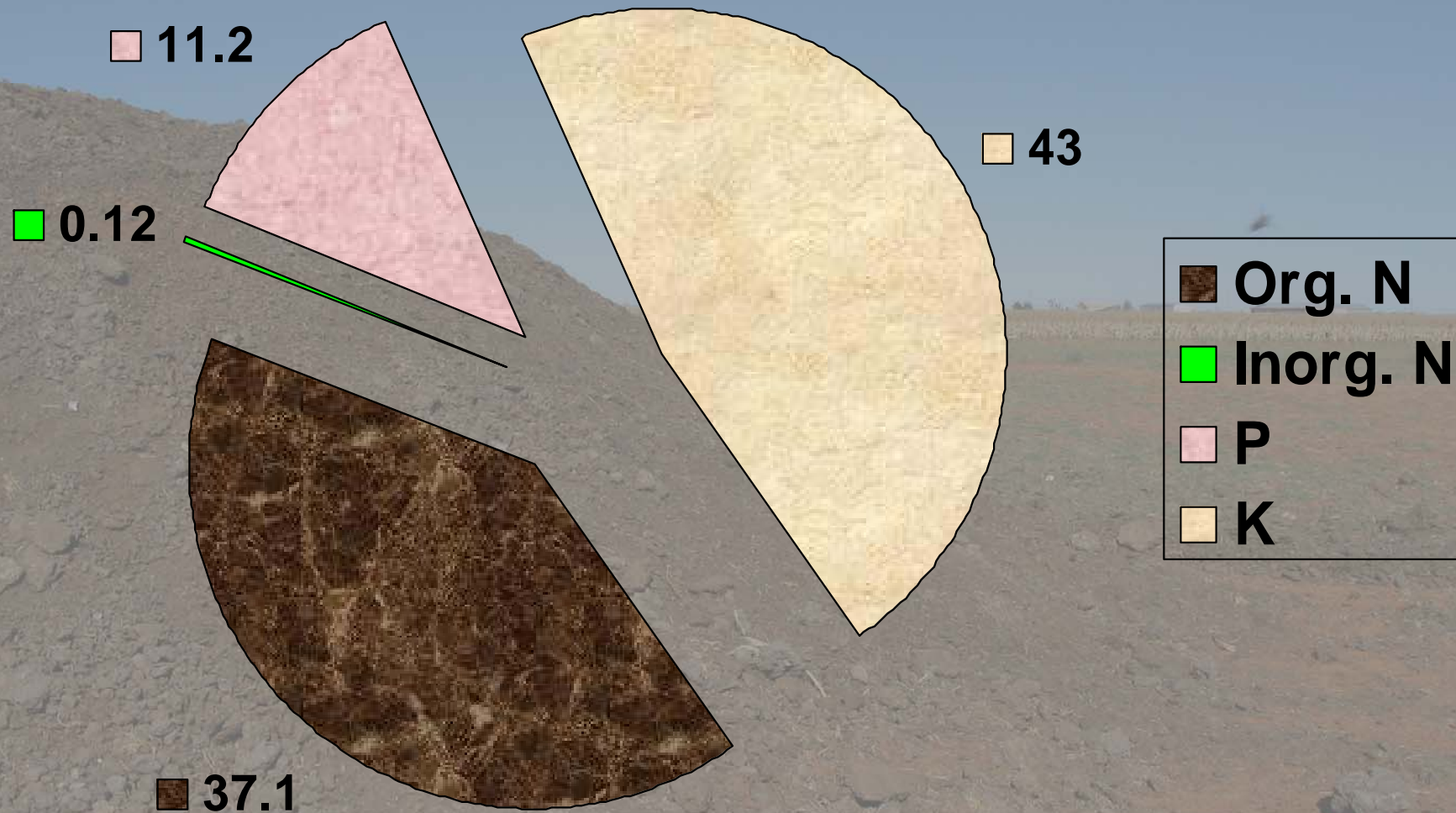
From NM 1999 survey

Pounds per dry ton

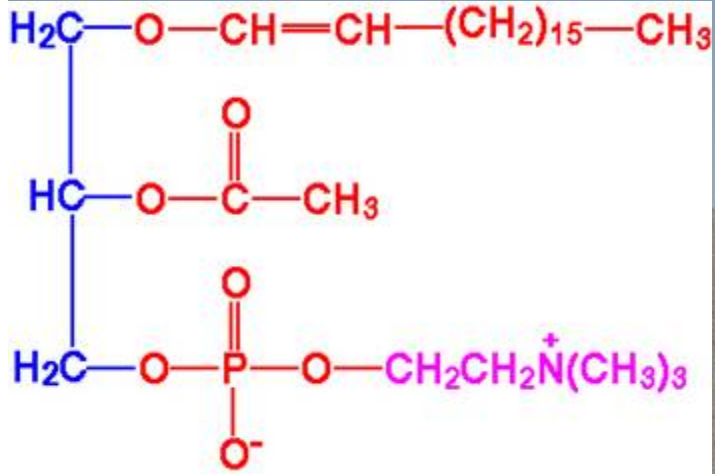


- Ash
- Carbon
- Sodium
- Org. N
- Inorg. N
- P
- K
- S
- Ca
- Mg
- Zn
- Fe
- Mn
- Cu
- Cl

N - P - K



Mineralization



Org-N

Time
Microbes
Moisture
Warm Temperature

NH₄-N

Soil
Microbes

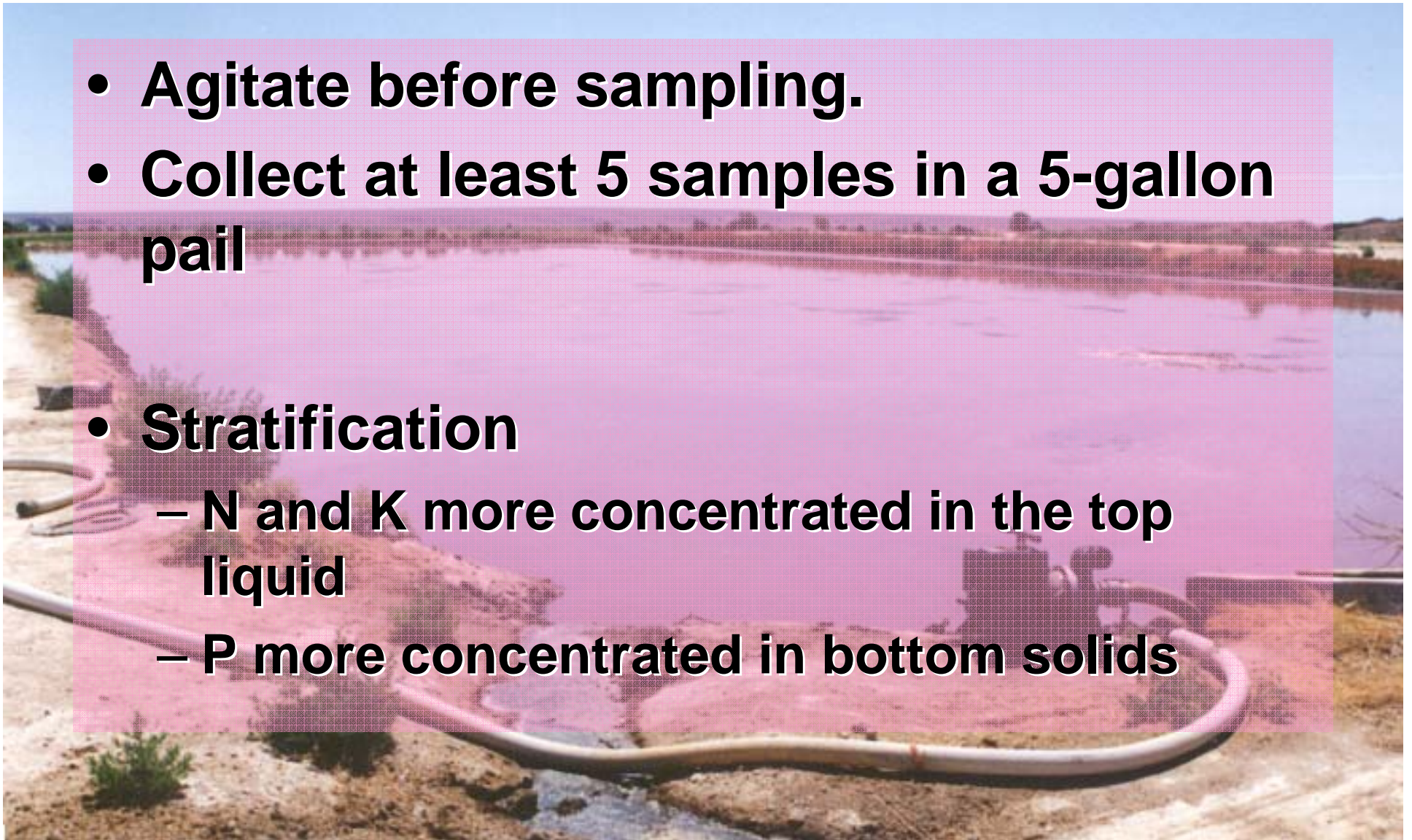
NO₃-N

LIQUIDS

- In the following procedures thoroughly mix
- A plunger works well for mixing liquids in a 5-gallon pail.
- Fill a 1 qt plastic bottle not more than $\frac{3}{4}$ full with the composite sample
- Store in freezer if not delivered to lab immediately.

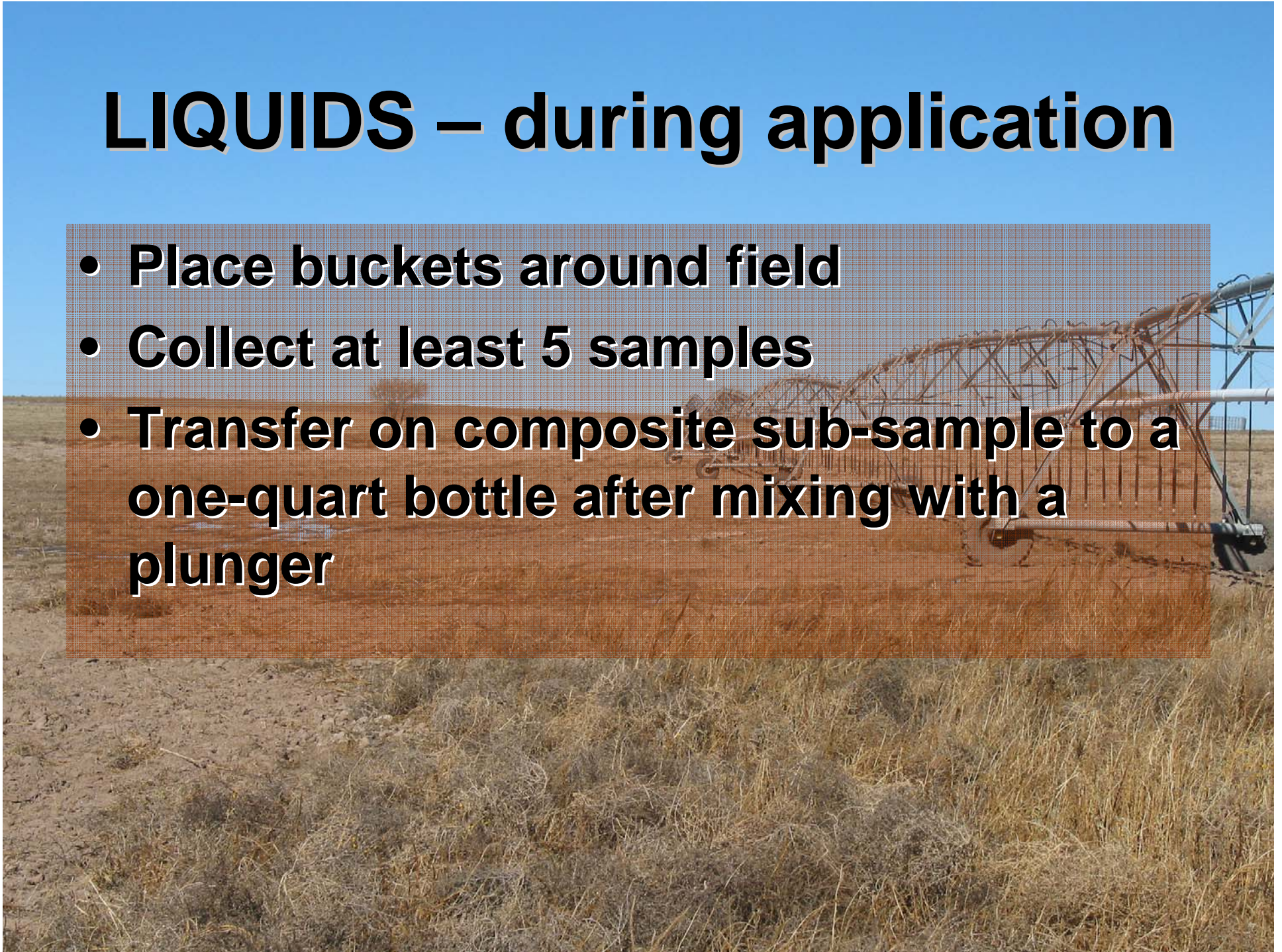
LIQUIDS – from storage

- **Agitate before sampling.**
- **Collect at least 5 samples in a 5-gallon pail**
- **Stratification**
 - N and K more concentrated in the top liquid
 - P more concentrated in bottom solids



LIQUIDS – during application

- **Place buckets around field**
- **Collect at least 5 samples**
- **Transfer on composite sub-sample to a one-quart bottle after mixing with a plunger**

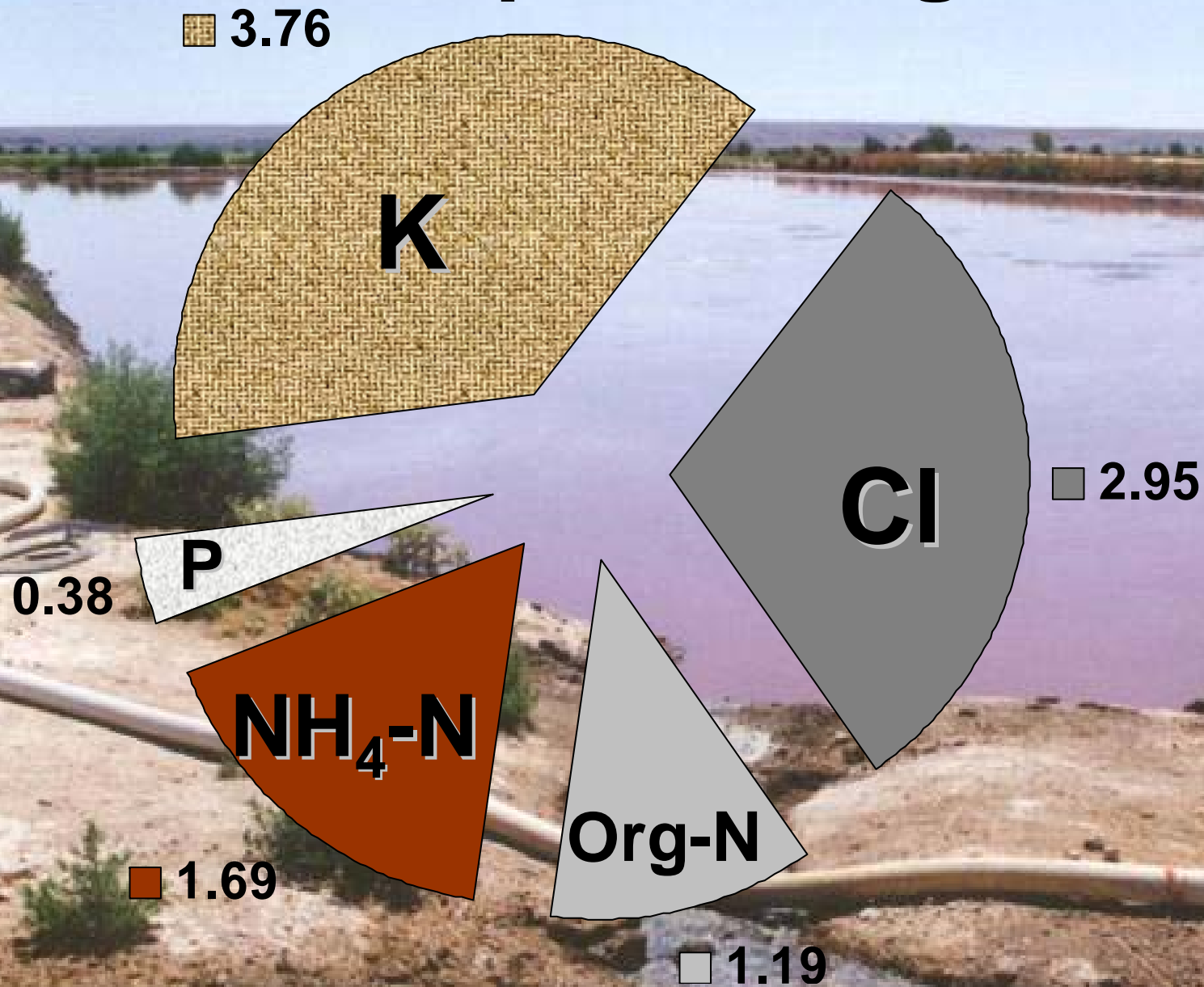


Selected Slurry Characteristics

	Org-N (mg/L)	NH ₄ -N (mg/L)	Nitrate-N (mg/L)	Cl (mg/L)	TDS mg/L
Median	142	203	0.10	353	290
Ave	165	246	0.14	486	349 ³
Max	760	998	0.8	2086	1210 ⁰
Min	1	32	0.1	106	279 ¹
Std. Dev.	140	154	0.1	373	215 ⁶

November 2003 NM

Pounds per 1000 gallons



Pounds per acre-inch

■ 102

K

Cl

■ 80

P

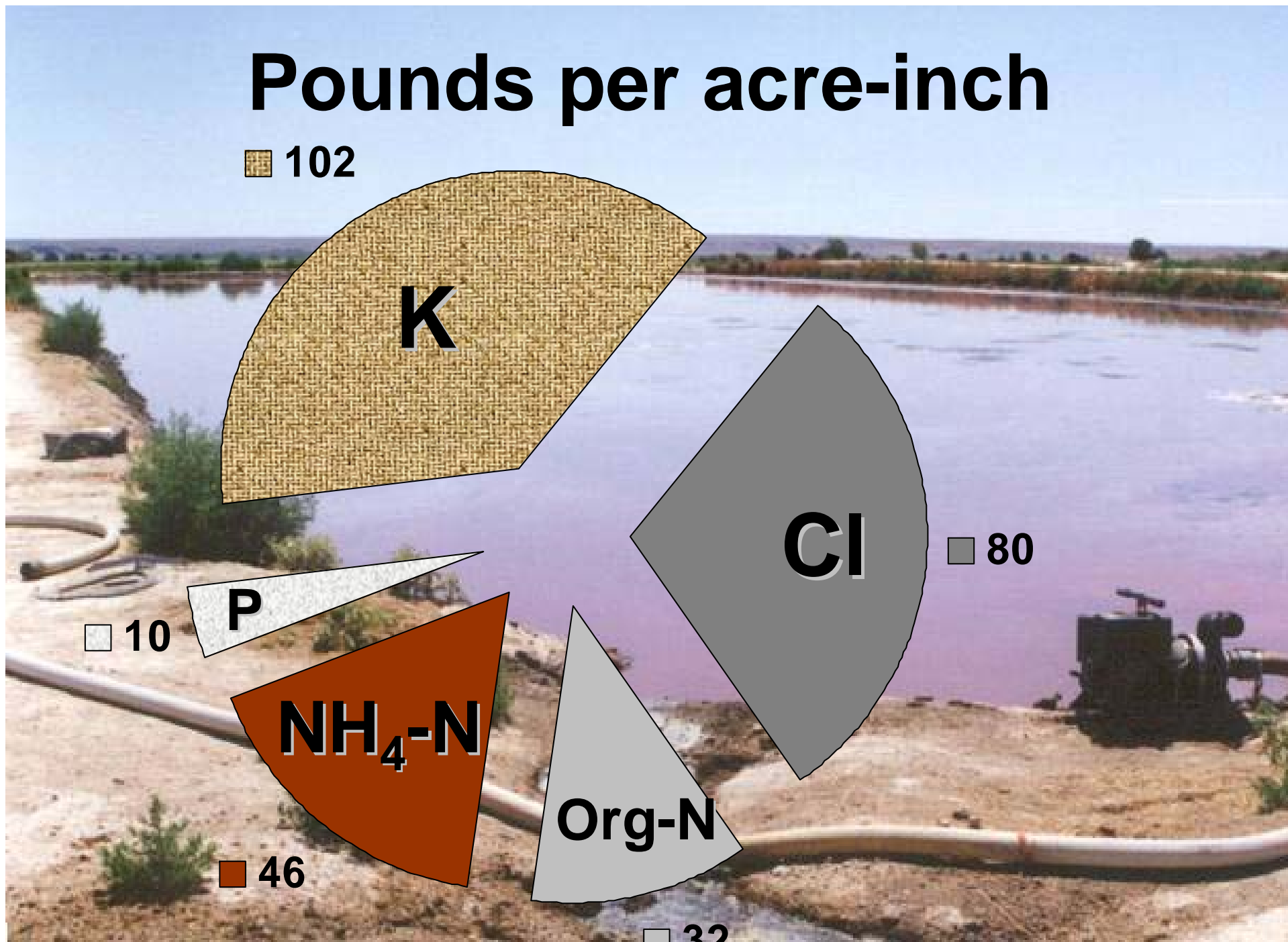
■ 10

NH₄-N

■ 46

Org-N

■ 32

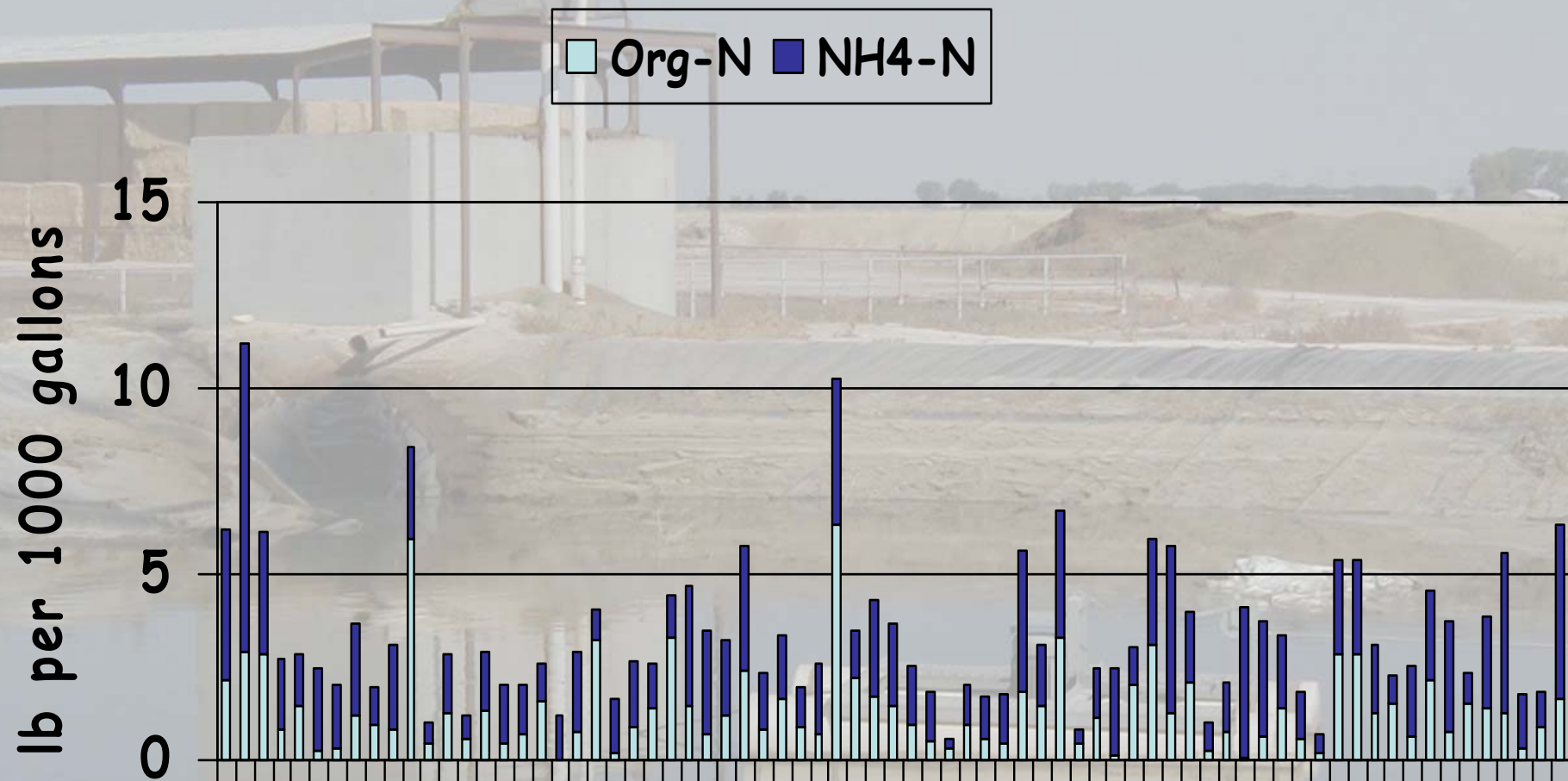


Water Quality

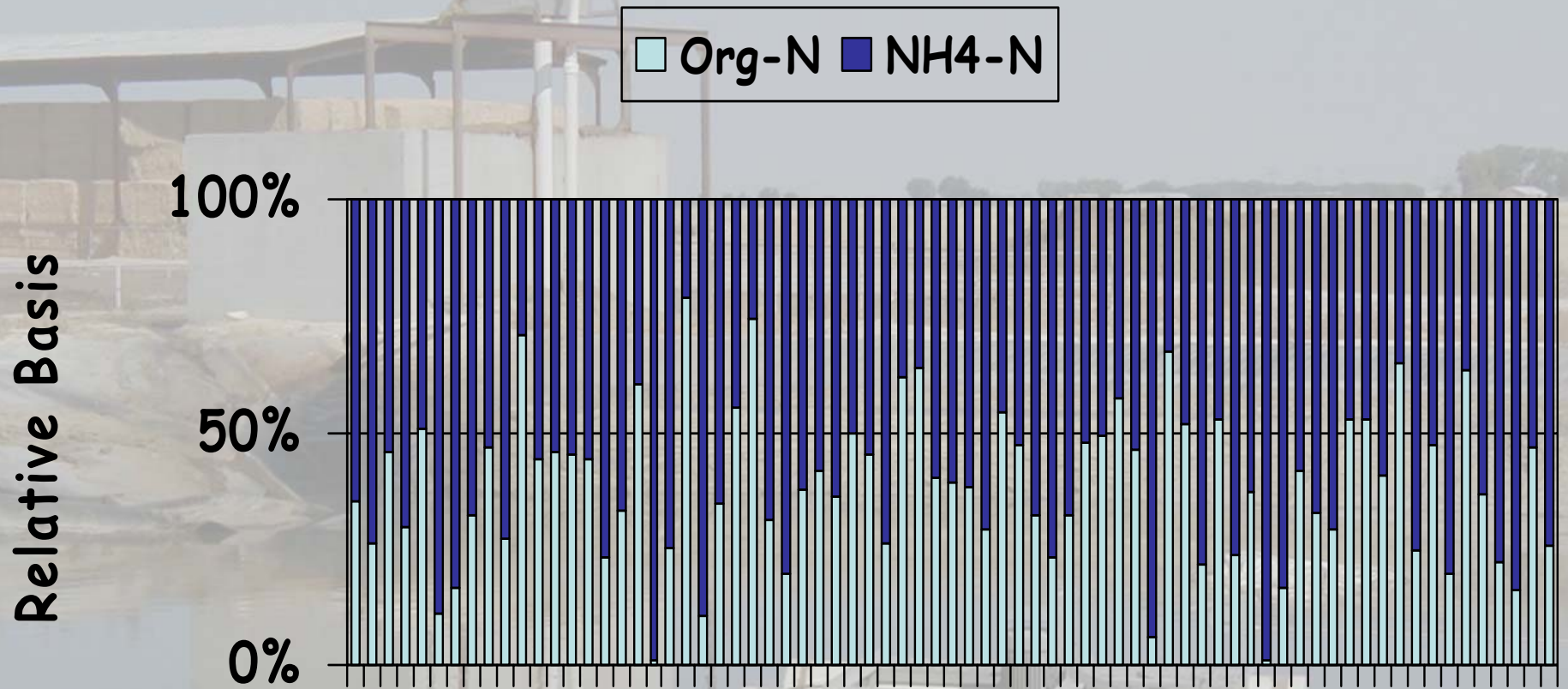
- **Electrical Conductivity**
 - 4.8 mmhos/cm
- **pH**
 - 7.8
- **Solids**
 - 0.4 % by volume
- **Total Dissolved Solids**
 - 2903 ppm
- **Chloride**
 - 353 ppm

- **Irrigation purposes**
 - < 3 mmhos/cm
- **pH**
 - < 8
- **TDS**
 - <2000
- **Chloride**
 - <69 ppm

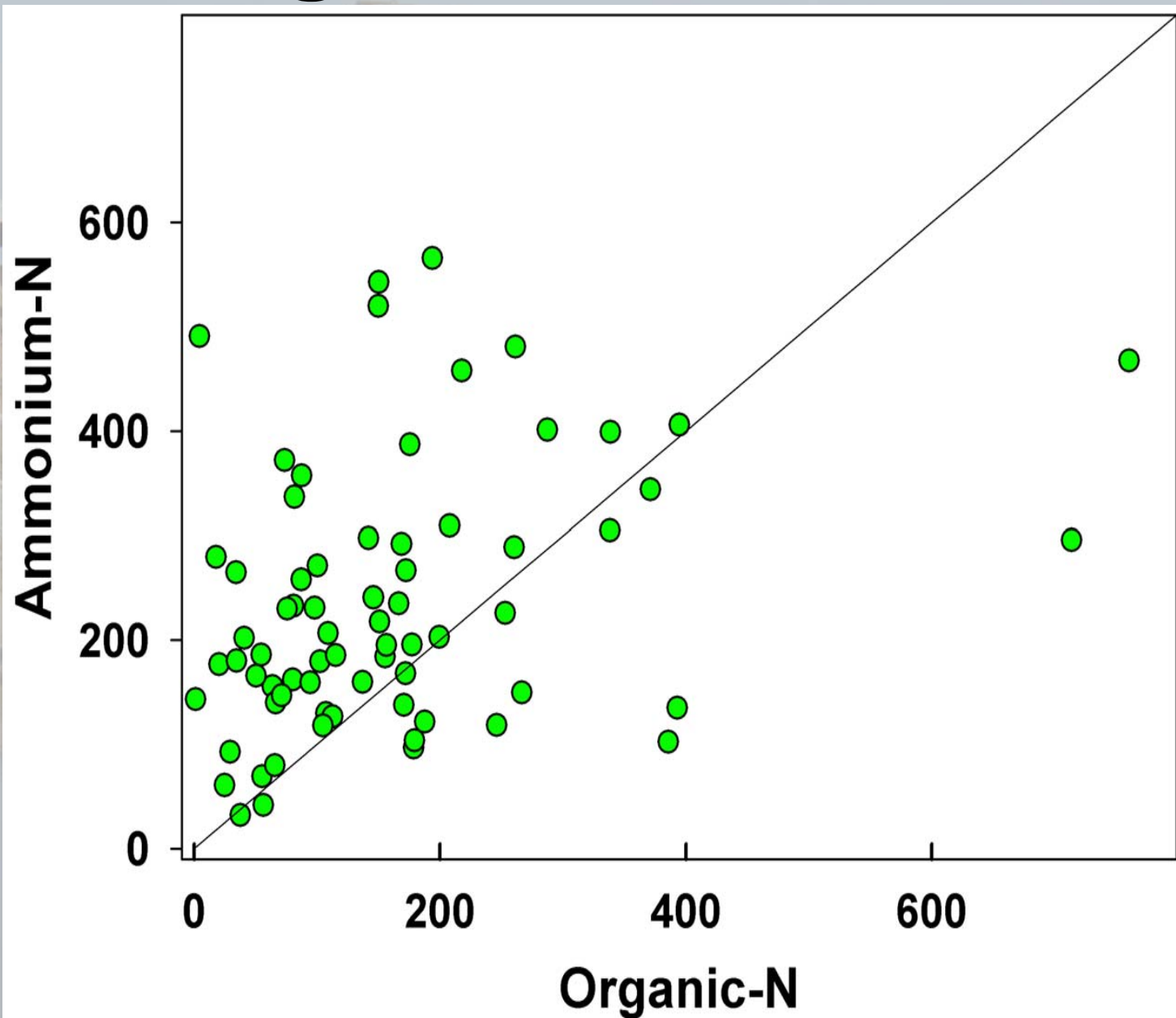
Lagoon Water N – Nov 2003



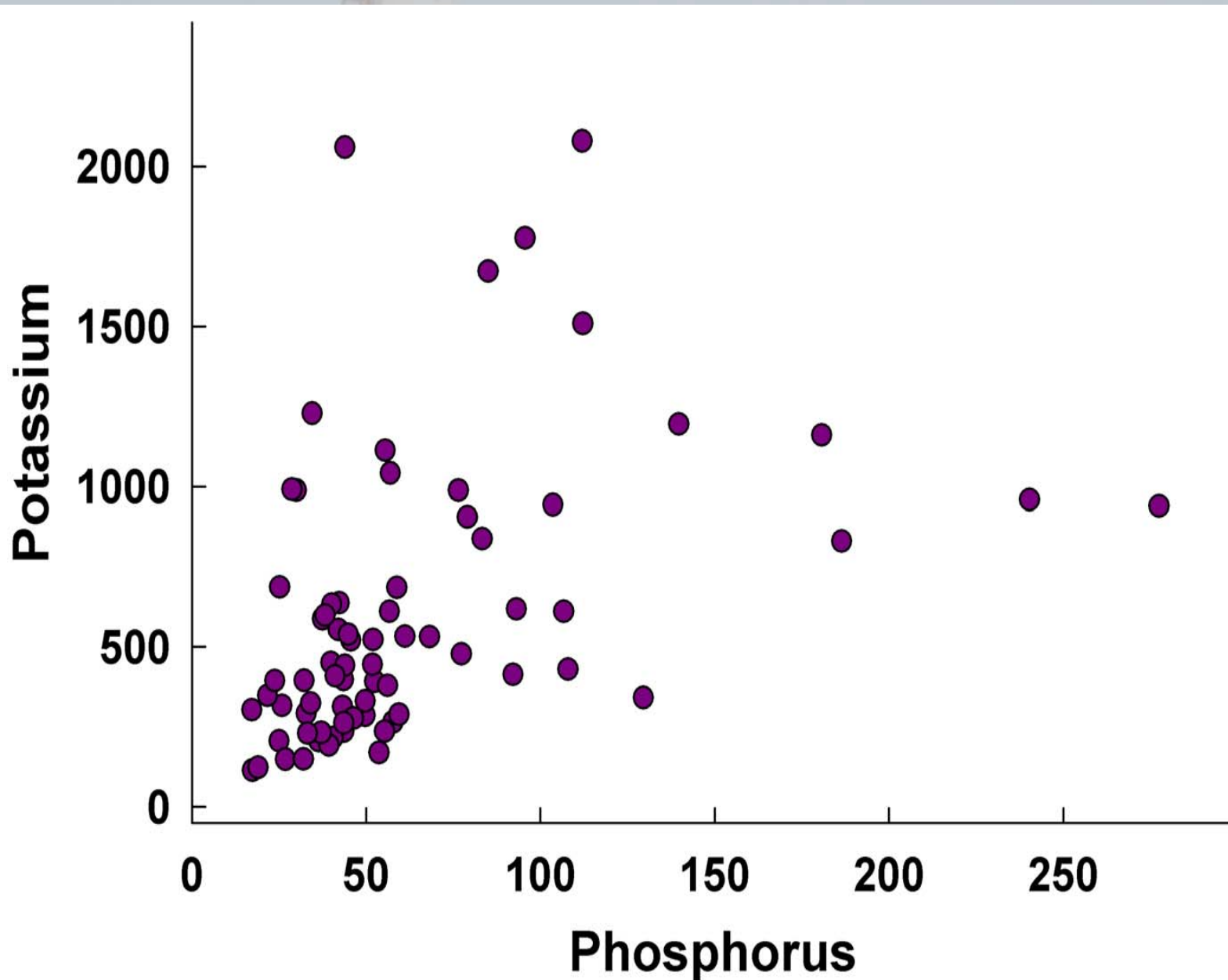
Lagoon Water N – Nov 2003



Lagoon Water N

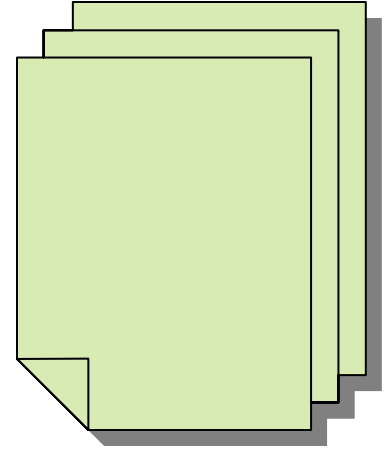


Lagoon Water P & K



SAMPLE IDENTIFICATION

- Farm
- Date
- Method of Application
- What tests
- Keep frozen until shipped or delivered to lab.
- Ship early in the week (Mon – Wed) & avoid holidays and weekends.



Test Minimums

- Total Kjeldahl N
 - Organic-N + Ammonium-N
 - Nitrate-N
 - Chloride
 - Phosphate-P or Total P
 - Potassium-K or Total K
 - Total salt
 - Sodium
- Liquids may require preservation by pH reduction